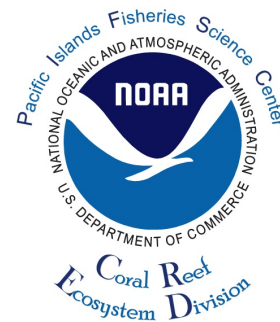


Analyzing REA Benthic Images (Stratified random sites)



PLEASE READ:

As of August 2014, this is the latest version of the SOP. Please note that this SOP only covers analysis of images from Fixed or Stratified Random sites. The SOP for analyzing images from Towed-diver surveys is found on a separate document (see [Wiki page](#) or contact [Paula Misa](#)).

Please ensure that prior to analysis, all photographs have already undergone appropriate post-collection processing in the field: That is, it is assumed that the photographs have been renamed appropriately, tagged, and cataloged in the appropriate folder within the V:\OPTICAL directory structure developed by the Data Management Team. If that is not the case, please contact [Troy Kanemura](#) before proceeding.

The process of "Checking-out" the images to be analyzed via the CRED Wiki has been eliminated. The Benthic Image Analysis (BIA) coordinator will be responsible for allocating sites and a spreadsheet containing the site assignments will, instead, be emailed directly to each analyst.

In addition, the BIA coordinator will copy the site assignment spreadsheet to the CRED Wiki, which will serve as an online tracking log. Each analyst is responsible for updating the tracking log on a daily basis (see Step 13).

I. ANALYZING IMAGES via CPCe

1. SET UP THE ANALYST FOLDERS

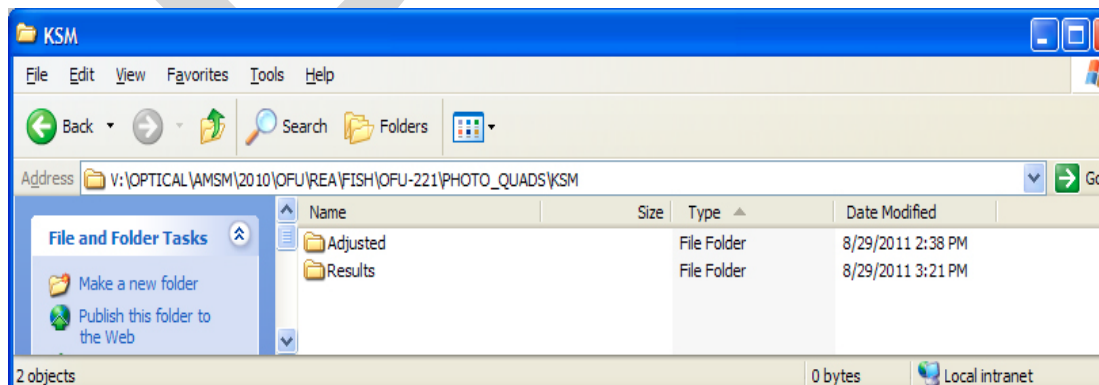
- Create a new analyst's folder within V:\OPTICAL\region\year\island\REA\FISH or BENTHIC\site\PHOTO_QUADS\
- Rename the folder with analyst's initials (e.g. KSM, HB, BVA).

** Please be advised:

If this is your first time analyzing images for CRED, your analyst initials and your affiliated institution (for non-CRED) need to be added by the Data Management team to the database prior to analysis. Please contact [Troy Kanemura](#) to ensure that this information has been added.

- Within the analyst folder, create the following folders:
ADJUSTED RESULTS

The folder structure should look like the following screen shot:



- d) Ensure that the Site folder and associated images within the PHOTO_QUADS folder have been renamed based on the following naming conventions:

Site name: "3lettersiteinitial-3or4sitenumbers" (e.g. **HAW-487**)

Image file name: *Sitename_YYYY_AorB_indexingnumber.jpg*
(e.g. **HAW-487_2011_A_01.jpg**)

*Stop

If there are errors with the images and/or folder naming convention (e.g. sites not having the proper site initials, images not renamed using the appropriate naming convention) please **do not** analyze these images or correct any problems yourself. Rather stop, and alert the Data Management Team ([Troy Kanemura](#)) or [Paula Misa](#) for guidance on renaming the affected directory/files, and proceed with the image analysis only after all naming inconsistencies are corrected. Skip the photo set for now and proceed to the next photo set if a quick resolution is not possible.

**Note:

The image file name indexing number is always a 2-digit number with a leading 0 (e.g. 01, 04, 09)

- e) Copy the images to be analyzed from the PHOTO_QUADS (for photos from Fish REA) or A/B folders (for photos from Benthic REA) within the V:\OPTICAL folder hierarchy to the **ADJUSTED** folder.

*Please be advised

Only those photos in the ADJUSTED folder should be modified (e.g. color correction, CPCe analysis, etc.). The images in the site folder should be considered as noneditable originals. They may be copied but not modified

2. **LAUNCH Coral Point Count with Excel Extensions (CPCe) program** and ensure it is version 4.12. To verify the software version, on the Help menu, select *About CPCe*. If version 4.12 is not installed on your computer, please install it as instructed [here](#), or contact [Paula Misa](#).

If installing and/or running CPCe V4.12 or later for the first time, the computer display resolution must be set at **96 dpi** or else the software may not run.

To do so (assuming that you are running on Windows 7),

- Move the mouse to the Desktop and right-click, select "Screen Resolution"
- From the bottom, click on "Make text and other items larger or smaller"
- From the left panel, click on "Set custom text size (DPI)".
- In the "Scale to this percentage of normal size" pull-down menu, select **100%**. The text at the bottom of the ruler should read: "9 point Segoe UI at 96 pixels per inch".

3. **Load the most recent CODE FILE**, which is the CRED standard version of the file CPCe uses to create the classification selection buttons

- Click on **Options** from the menu bar
- Select **Specify code file**
- Navigate to **V:\OPTICAL\ANALYSIS\CPCe_CONFIG**
- Select the **CRED_Str_benthic_codes_40.txt** code file (when analyzing photos after 2013 or unless instructed to use the old code file), select Open.

The different code buttons for classifying the benthos appear along the bottom of the screen, grouped and color-coded by both Tier 2/3 and Tier 1 category, separated by non-functional black buttons.

4. **Open the images** to be analyzed from the **ADJUSTED** folder in the V:\OPTICAL hierarchy. An entire transect of photos can be opened at one time.

- a) On the File menu, select **Multiple images/file processing**.
- b) On the drop-down menu, select **Process multiple images**.
- c) In the Auto-advance fileset information dialog box, click the ***Automatically retrieve header data for all images but the first*** check box found at the bottom of the screen.
- d) From the left panel of the dialog box, navigate to the folder containing the photos to analyze.

V:\OPTICAL\region\year\island\REA\FISH\site\PHOTO_QUADS\analyst\ADJUSTED

- e) Select all of the images to be analyzed and click **Start file processing**.

5. **HEADER DATA:** On the Point count header information window, the following fields need to be populated under the **Photo/Analysis Information**:

- a) **Analyst:** enter the analyst initials as they are stored in the database
Analysis date: enter the current date in the format *MM/DD/YYYY*
Institution: enter your affiliated institution.
 For the majority of the analysts, enter "*CRED*".
 For subcontractors, enter "*CRED contractor*".
 For student interns/volunteers, enter "*CRED intern*".
- b) After the 3 fields have been populated, click the **Save and cache header data**
- c) Click **OK** and click the **Close** button on the Point count header information window.

6. **CONFIGURE CPCe** with the following settings:

- a) Verify CPCe will **use the proper area in each photograph for analysis**. The edges of survey photos will be excluded from analysis due to distortion.
 1. Under the **Mark border** menu, select **Mark/remark region border**.
 2. In the **Marking the border** warning dialog box, click the **Yes** button, acknowledging this action will cause existing analysis points to be erased. This is acceptable, as no classification has yet been performed on this photo set.
 2. In the **Specify the border boundaries** dialog box, select **Specify border offset (pixels)**.
 3. Enter **60** in the **X-offset** window, **42** in the **Y-offset** window and then click the **OK** button.
 4. A rectangle should appear on the image, inset from the edges, and the classification points should appear only within the rectangle. You can change the color of the rectangle by clicking on **Options** in the menu bar, then **Data point graphical parameters**. In the **Data point color options** box, click on "Frame border" and select the desired color from the color palette. Click the "OK" button and then "OK" button again

***Useful Information**

By specifying an image boundary other than the entire image, CPCe will display the **Specify the border boundaries** window each time a new image is opened for analysis. CPCe remembers the previously-entered **X-offset** and **Y-offset**, so you merely need to press the **OK** button to continue.

- b) Verify CPCe will randomly **distribute 10 points** per photo.
 1. Under the Point Overlay menu, select **Specify/apply overlay points**.
 2. In the Data point positions dialog box, select **Stratified random**.
 3. Number of rows, type **2**.
 4. Number of columns, type **5**.
 5. Number of random points per cell, type **1**.
 6. Click the **Overlay points** button


- c) Under the Options menu, *check*:
Number symbols
Auto-advance point
Auto-follow
Maintain zoom
- d) Under the Options menu, select **Data point graphical parameters**.
 - 1. Select Circle/crosshairs.
 - 2. In the Diameter text box, type **12** and click the OK button.
 Click the OK button again verifying the selected options.

***Useful Information**


CPCe remembers/uses the image boundary and point symbol settings from steps 8a-8d each time the program is run. So, these steps will not need to be implemented again unless directed to do so.

7. BEGIN ANALYSIS

- a) In the Point Data dialog box on the right of the CPCe screen, click in the 1st row in the ID (i.e. left-hand) column.
- b) The analysis point 1 on the image will change to the color designated for "current focus data point" (aqua by default).
- c) Decide which benthic category lies directly underneath this point's cross-hair and click on this category from the classification buttons at the bottom of the screen. The category code is automatically entered in the cell, and the data point changes to the color chosen for "assigned data point" (red by default).
- d) The cursor automatically advances to the next point.
- e) Repeat 7 a-d until all points on the image are classified
- f) For guidance on selecting the correct category, please see IMAGE ANALYSIS GUIDELINES

- 8. Click the **right arrow button**  ("Next file in dataset") beneath the Point Data dialog box, which scrolls to the next image selected for analysis.
- 9. Repeat steps 7-8 to continue analyzing and saving additional images in the photo set.

10. SAVING THE DATA

After analyzing the last image on the photo set, click on the  **floppy disk icon** at the bottom right of the Point Data dialog box ("save data to file").

- a) In the Save data to .cpc file dialog box, navigate to the ADJUSTED folder containing the analyzed images:

V:\OPTICAL\region\year\island\REA\team\site\PHOTO_QUADS\analyst\ADJUSTED

- b) In the File name text box, double-check that the name of the file to be saved matches the site photo_id.cpc format.
- c) Click the Save button.

*** Please be advised:**

The starting directory displayed in the Save data to .cpc file dialog box may not be the appropriate ADJUSTED folder hierarchy (and most likely the ADJUSTED folder from the previously analyzed site). Just like Word or any other Windows application, the Save dialog window has to have a starting directory to display when saving a new file. CPCe, especially when started for the first time, has no "memory" of previous directories where files have been opened or saved. So, it defaults to a directory that it

does remember; the directory in which it was installed on the C: drive. Please take your time and navigate to the proper ADJUSTED folder on the V: drive.

**** Do not move files once image analysis has begun!**

Due to the way CPCe stores data in its .cpc files, please do not change the location of the code file, .jpg, or .cpc files once analysis on a photo set has begun. Doing so will create many data processing problems.

11. EXPORT CPCe RESULTS FILES

When all photos in the set have been analyzed, export the classification data to Microsoft Excel:

- a) Under the File menu, select the **Save** pull-down menu.
- b) Select **Save .cpc file(s) to Excel**.
- c) **Close any currently running Excel programs** and click the OK button.
- d) In the Batch processing of .cpc files into Excel dialog box, on the left panel, **ensure that the appropriate ADJUSTED folder has been selected**. If not, navigate to the correct folder where the analyzed .cpc files are stored.
- e) Click **Select all files**.
- f) Select New Excel workbook and type the site name in the "Transect name" box (e.g. **HAW-487**)
- g) Select **Create a .csv file**.
- h) Select **Database friendly column names**.
- i) Ensure that Place each .cpc file in its own transect is **NOT checked**
- j) Ensure **Archive** is selected in the Optional Excel outputs section of the dialog box. This is new in CPCe version 4.1.
- k) Click the **Process files button**.
- l) When prompted to 'Specify format of saved Excel workbook', select **.xlsx (Open XML)**
- m) After a few moments of processing, the New Excel Workbook window appears.
- n) Make sure to navigate to the appropriate **RESULTS** folder
- o) In the File name text box, type the name of the site from which these photos were analyzed (Example: **HAW-487**)

*** Note**

A common mistake that analysts have made in the past was to include the survey year suffix to the site name when naming the results workbooks (Example: HAW-487_2013). Follow the proper naming convention to minimize errors in the data QAQC process.

- p) Click the **Save** button.
- q) Click the **OK** button when notified the files have been saved.

12. VERIFY THE FOLLOWING:

- a) Verify that **two spreadsheets** with the file extensions .xlsx and.csv were saved to the appropriate RESULTS folder

V:\OPTICAL\region\year\island\REA\team\site\PHOTO_QUADS\analyst\RESULTS.

- b) Verify that both spreadsheets were named with the **proper naming convention** (e.g. HAW-487.xlsx and HAW-487.csv)
- c) Open the Excel workbook (.xlsx) and verify that it is properly formatted. In particular, verify the existence of the **site_imgsummary** and **_archive** worksheets. If those worksheets are not present, delete the Excel workbook, repeat step 11, and at step 11-i, ensure **Place each .cpc file in its own transect is not selected**, and at step 11-j, ensure **Archive is selected** in the Optional Excel outputs section of the dialog box.
- d) While viewing the Excel workbook (.xlsx), select the **_archive** worksheet and scroll through the

“Institution”, “Analysis_Date” and “Analysis_Tech” columns from rows 2 to 301 to ensure that all cells have been populated. If not, go to column “File_Name” and navigate to the .cpc file with the **missing header data**. Repeat steps 5, 10, 11 and 12.

13. **UPDATE THE TRACKING LOG** to indicate that image analysis for that set has been completed.
To update the tracking log:

- Navigate to the CRED wiki: [Benthic Image Analysis - Assignments](#)
- Click on the appropriate production series (e.g. Stratified Random - MHI 2013)
- On the upper right side, click **Edit**
- Find the completed Site Name (e.g. HAW-487) and update the **ANALYSIS_COMPLETED** field with the **date** the CPCe Excel results workbook was exported
- Type any comments relating to the images in the NOTES field. Information that is applicable to enter in this field are: # of images analyzed; which images are of poor quality and were discarded; any info that the coordinator/data management team need to be aware of.
- On the **GIANT CLAMS** column, regardless of whether the point landed on the giant clam mantle or not, record the name of the image where a giant clam/s was observed.

YEAR	REGION	ISLAND	TYPE	SITE	ASSIGNED_TO	ANALYSIS_COMPLETED	ANALYSIS_DATA_IN_DB	GIANT CLAM (if present, enter "IMAGE_NAME" e.g. KAU-301_2013_A_01)
2014	MARIANA	MAUG	Fish	MAU-202	HB			MAU-202_2014_A_01, MAU-202_2014_A_09, MAU-202_2014_A_22, MAU-202_2014_A_29

*If you have any difficulties/question regarding the tracking, please contact [Paula Misa](#).

II. IMAGE ANALYSIS GUIDELINES

1) REFERENCES

Several references are available on the CRED Wiki and other websites:

[Classification Tiers, Categories, Definitions for Tiers 1 and 2](#)
[Dichotomous Key for the Classification of Benthic Functional Groups](#)
[Annotated Training Images](#)
[Tier 3 coral codes](#)
[AIMS Coral Fact Sheets](#)
[Guam Reef Life](#)

***Note

Beginning 2013, CRED BIA has transitioned to analyzing images at a finer taxonomic level. Additional references will soon be added to the CRED Wiki to help make classification decisions at this level. In the meantime, please refer to field guides (Veron, Erhardt & Knop, Fenner) or the above web links.

2) WHEN IN DOUBT

When in doubt, leave the point blank until you can consult with an expert or colleague who is familiar with the area. If a subject matter expert is not available and/or you're still not able to confidently classify the point, use the [Unclassified](#) category. **Do not guess if you're not able to confidently classify the point.**

3) RELAYING NEW POINTS

If any photo has more than **5 combined points** classified as [Shadow](#) or [Unclassified](#), please

do not save those data. Rather, generate a new set of points to analyze by using the Point Overlay menu and selecting **Recalculate point coordinates**. Click the Yes button in the window warning that previous data for that image will be erased. Repeat this step **no more than 3 times** before discarding the photo altogether. Remember, 3 strikes and you're out.

4) **POOR IMAGE QUALITY**

In rare cases for sites with images whose quality is insufficient for use, **50% (15) images is the minimum acceptable number that needs to be analyzed** to grant retention of those data in the production series. Any site with < 50% of analyzable images probably introduces more bias than reliable data and thus should be excluded from the analysis.

5) **MULTIPLE GROWTH FORMS**

If analyzing to a finer taxonomic resolution:

Refer to the **Tier 3 codes** spreadsheet that maps Tier 3 (genus/species) to its corresponding, fixed, Tier 2 (functional group) category

If analyzing to functional groups:

Classify the coral colony based on the morphology directly under the point rather than the overall colony morphology

6) **POINT BETWEEN TWO BENTHIC CATEGORIES**

If a point falls precisely between multiple coral growth morphologies, or on the border between multiple benthic categories (e.g., coral-algae), the benthic category occupying the greatest area within the symbol (circle wrapping the cross-hairs) will be classified. Additionally, if the multiple benthic categories occupy equal space within the symbol, the benthos falling on the top left quadrant within the point symbol will be classified.

7) **UNCLASSIFIED/UNKNOWN, SHADOW, WATER COLUMN**

The category **Shadow** should be used when the point falls on an area that is dark and the nature of the benthos cannot be assessed due to diminished light.

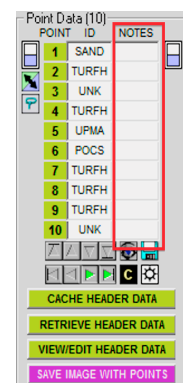
The category **Unclassified** should be used when the nature of the benthos cannot be determined due to image quality or unfamiliarity with the type of benthos.

In rare cases when the point falls on the water column, classify the point as **TAPE** in order to remove that point from the benthic cover estimate. (Note: the categories Tape and Wand are excluded from percent cover estimates).

8) **NOTES COLUMN**

For points classified as **Hard Coral**, record any occurrence of **coral bleaching** and **COTS** predation by using the BLE and PRED buttons.

- In the Point Data dialog box on the right of the CPCe screen, click in the NOTES (i.e. right-hand) column for the point(s) that have either bleaching or COTS predation.
- Click the NOTES classification button as appropriate.
- Only the buttons (in white) found on the lower right portion of the screen can be designated to the Notes column area.
- A bleached coral should be classified first by the appropriate growth morphology/taxon.
- COTS predation scars on corals should be classified as **hard substrate** (non-visible turf).



9) NAVIGATION TIPS

- a) You can enlarge the view under an active point by left-clicking on the image. Return to the normal view by right-clicking.
- b) You can hide all of the random points on the image to get an unobstructed view by clicking on the "eye" icon at the bottom of the point data column. Click again to show the points.
- c) You can turn off all of the random points except the one to be classified by using the "isolation mode" (sun-looking) icon at the bottom right of the Point Data dialog box.
- d) If the benthos in the image is simple (e.g. sand with a few small rubble areas) in which most points have the same classification (e.g. sand), you can categorize those few points that are different (e.g. rubble). Then click on the icon on the upper left of the Point Data dialog box ("select all points with blank ID fields"), and choose their classification (e.g. sand). All those fields will be classified in one batch.

END (August 2014)

Version Documentation:

V.2 - August 2014 (c/o Paula Misa, Bernardo Vargas-Angel, Brett Schumacher)

The following steps have been modified with the August 2014 version of the SOP:

- Removed steps specific to analysis of images from towed-diver surveys
- Removed "checking out process" from the CRED Wiki
- Reorganized steps and moved *image analysis tips and guidelines* to the bottom of the document
- Revised SOP to reflect CRED's transition to analyzing images at a finer taxonomic order (e.g. new code file; addition of corals under the proposed ESA list under the NOTES column; addition of the Tier 3 code.xlsx as reference, etc.)
- Added guidelines when populating the Header Data. In particular the institution to enter when the analyst is non-CRED.
- Updated guideline instructions for setting computer resolution prior to CPCe use.
- Added protocol to ensure that all "Header Data" have been populated
- Added protocol to specific .xlsx (Open XML) as the Excel spreadsheet file format
- Added steps to add a border on the image to prevent points from being distributed on the edge of the image where aberrations/distortions are likely to occur
- Added a protocol when analyzing a photostet where <50% of the images are of poor quality/insufficient for use
- Added a protocol to note the file name of images where giant clams were observed in the Wiki tracking log

V.1 - December 2011 (c/o Jeff Anderson)

The following steps have been changed with the Dec. 2011 version of the Benthic Image Analysis SOP:

- Steps 1 & 17 for checking-out and checking-in photo set analysis and completion.
- Step 2.a.iii or 2.b.iii for adding the folder layer with your diver database initials.
- Step 4 for new CPCe version 4.12.
- Step 12.b for handling situations when more than 5 Unclassified/Shadow points occur in an image and/or tows that have several photos of poor quality.
- Steps 16.i & j for new options to select when creating the Excel results workbooks.